REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended each of claims 1 and 3 to recite that the controller is for controlling a relative distance in a tool insertion direction "and" an insertion depth of the tool into the work; and to recite support structure for the rotating tool such that when the rotating tool is inserted into the work the rotating tool is tilted at a predetermined angle θ to the work toward a rear side with respect to a direction of moving the rotating tool relative to the work. Applicants have amended claim 5 to positively recite the processing step of inserting a rotating tool into the work and moving the rotating tool relative to the work, wherein the inserted rotating tool is tilted at a predetermined angle θ to the work toward a rear side with respect to a direction of movement of the rotating tool relative to the work; and to recite controlling a relative distance in a tool insertion direction "and" an insertion depth of the tool. Note, for example, the structure shown in Figs. 2 and 3 of Applicants' disclosure. Claims 2, 4 and 6 have been amended in light of amendments to claims 1, 3 and 5.

In addition, Applicants are adding new claims 7-9 to the application. These claims 7-9, respectively dependent on claims 1, 3 and 5, define that further aspect of the present invention wherein the rotating tool has first and second portions with the second portion having a larger diameter than the first portion and a shoulder being provided between the first and second portions, and wherein when the rotating tool is inserted in the work a front part of the shoulder, in the direction of movement of the rotating tool relative to the work, is not inserted in the work, and a rear part of the

shoulder, in the direction of movement of the rotating tool relative to the work, is inserted in the work. Note, for example, Figs. 2 and 3 of Applicants' original disclosure.

Applicants respectfully traverse the rejection of their claims 1-5 under the judicially created doctrine of obviousness-type double patenting, over claims 1-3 of U.S. Patent No. 6,729,526, particularly insofar as this rejection is applicable to the claims as presently amended. In this regard, note that the Examiner has not rejected claim 6 under this judicially created doctrine of obviousness-type double patenting. In any event, as will be shown infra, it is respectfully submitted that the subject matter claimed in claims 1-3 of U.S. Patent No. 6,729,526 defines a separate patentable invention from the subject matter of the present claims, such that the obviousness-type double patenting rejection is improper.

U.S. Patent No. 6,729,526 claims (in claims 1-3) a friction stir welding apparatus and method. The apparatus include claims 1 and 2 various means including a revolution speed setting means, insertion speed setting means, load factor setting means, hold time setting means and joining speed setting means, each of these means being further defined, in addition to a controller for controlling a relative distance in a tool insertion direction between the tool and the work or an insertion depth of the tool into the work. Method claim 3 of U.S. Patent No. 6,729,526 recites various steps including, inter alia, inserting the rotating tool into the work at a constant insertion speed; and, when a predetermined load factor of a spindle motor relative to a maximum tool rotation output or a predetermined insertion depth of the tool into the work is reached, holding the rotating tool where it

is for a predetermined duration. Especially in view of the additional features recited in the claims of No. 6,729,526, it is respectfully submitted that the claims of No. 6,729,526 define a separate patentable invention than the claims of the above-identified application, and thus the obviousness-type double patenting rejection is improper.

The contentions by the Examiner in Item 2 on page 2 of the Office Action mailed September 17, 2004, that while the present claims and the claims of No. 6,729,526 are not identical, "they are not patentably distinct from each other because both teach a friction stir welding apparatus comprising a controller for controlling relative distance in a tool insertion direction or an insertion depth of the tool so that a load factor or electric current of the spindle motor is within a predetermined range"; and that "[b]oth methods comprise the steps of inserting the rotating tool into the work and moving the rotating tool while controlling the relative distance in a tool insertion direction or insertion depth so that a load factor or electric current is within a predetermined range", the Examiner stating that the instant claims "are slightly broader", are noted. However, it is respectfully submitted that the claims of No. 6,729,526 include additional features than the controller; and, moreover, are silent with respect to tilt of the rotating tool, which is now recited in all of the present claims, and recite controlling the relative distance or insertion depth (rather than controlling the relative distance and the insertion depth as in the present claims). In view of the differences between the presently claimed subject matter and the subject matter of claims 1-3 of No. 6,729,526, it is respectfully submitted that the claimed subject matter of the U.S. patent defines a separate patentable invention from the

subject matter claimed in the present claims, such that the obviousness-type double patenting rejection is improper.

Applicants respectfully submitted that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the non-disqualified prior art applied by the Examiner in rejecting claims in the Office Action mailed September 17, 2004, under the provisions of 35 USC §102 and 35 USC §103.

Initially, please note that the applied U.S. patents to Yoshinaga and to Hirano, et al. (respectively, No. 6,708,865 and No. 6,540,128) qualify as prior art only under 35 USC §102(e), in connection with the subject matter claimed in the above-identified application. **Moreover, it is hereby stated by the undersigned that the above-identified application, on the one hand, and each of U.S. Patent No. 6,540,128 to Hirano, et al. and No. 6,708,865 to Yoshinaga, on the other, were, at the time the invention of the above-identified application was made, owned by the same company (Hitachi, Ltd.).** Furthermore, noting that the above-identified application was filed March 15, 2004, it is respectfully submitted that Hirano, et al. and Yoshinaga are disqualified as prior art under 35 USC §103. As will be shown in the following, since the rejection over each of Hirano, et al. and of Yoshinaga under 35 USC §102 is improper, no "prior art" rejection using the teachings of these patents is proper.

It is respectfully submitted that the references as applied by the Examiner would not have taught, and would not have suggested, such apparatus as in the present claims, including the controller for controlling a relative distance in a tool

insertion direction between the tool and the work and an insertion depth of the tool into the work so that the load factor or electric current of a spindle motor for rotating the tools within a predetermined range, with support structure for the rotating tool such that the inserted rotating tool is tilted at a predetermined angle θ to the work toward a rear side with respect to a direction of moving the rotating tool relative to the work. See claims 1 and 3.

In addition, it is respectfully submitted that the prior art would have neither taught nor would have suggested such a method as in the present claims, including the insertion step of the rotating tool, wherein the inserted rotating tool is tilted at a recited predetermined angle θ; and the further step of controlling a relative distance in a tool insertion direction between the tool and the work during the joining operation and an insertion depth of the tool into the work so that a load factor or electric current of a spindle motor for rotating the tool is within a predetermined range. See claim 5.

Moreover, it is respectfully submitted that the teachings of the applied prior art would have neither disclosed nor would have suggested such a friction stir welding apparatus or method as in the present claims, having features as discussed previously in connection with each of claims 1, 3 and 5, and, moreover (but not limited to), wherein a laser displacement meter or a contact type displacement meter is also used, for detecting relative distance in a tool insertion direction between the tool and the work during the joining operation and the insertion depth of the tool into the work (see claims 2, 4 and 6); and/or positioning of the rotating tool in the work as in claims 7-9.

Particularly through use of the controller as in the present claims, with the rotating tool being tilted as in the present claims, a strong joint can be achieved, with a stable bead quality of the friction stir weld, without production of burrs. Note, for example, page 19, lines 13-24 of Applicants' specification.

Hirano, et al. discloses a friction stir welding method and apparatus, suitable for joining plural workpieces in a complicated three-dimensional shape. The method is described generally in the paragraph bridging columns 2 and 3 of this patent. Note also column 4, lines 17 and 18, of this patent, stating that it is basically possible to joint workpieces while detecting a joint line with use of a sensor. Note also column 4, lines 39-42. This patent also discloses in column 7, lines 52-60, use of a sensor of the type having a wide measurement range in the width direction of the joint region as a sensor for measuring the distance between workpieces and the rotating tool, for ensuring the soundness of the joint region by drawing the joint line and the axis of the rotating tool to be as close as possible in the width direction.

It is respectfully submitted that Hirano, et al. would have neither taught nor would have suggested the controller as in the present claims, used with the tilted rotating tool, and advantages thereof, as discussed previously. Moreover, it is respectfully submitted that Hirano, et al. is disqualified as prior art under 35 USC §103, as shown previously.

Yoshinaga discloses a method and device for cutting and friction-stir-welding of metal material, providing a compound machining device which is capable of carrying out the cutting and bonding processes using a single device. The device is described generally in the paragraph bridging columns 1 and 2 of this patent. Note

also column 3, lines 8-11 and 50-55; column 4, lines 6-9, 15-27 and 42-65; and column 5, lines 46-49.

It is respectfully submitted that Yoshinaga is primarily concerned with providing a device and method wherein a single machine is used for carrying out both cutting and bonding processes, having a control unit capable of simultaneously controlling five coordinate systems. It is respectfully submitted that this reference does not disclose the apparatus and method as in the present claims, including the recited controller, used with the rotating tool that is tilted, as in all of the present claims, and advantages thereof.

Moreover, it is respectfully submitted that neither of Yoshinaga or Hirano, et al. would have disclosed the other features of the present invention as in the dependent claims. And, furthermore, as shown previously, Yoshinaga and Hirano, et al. are disqualified as prior art under 35 USC §103.

Adams, et al. discloses automatic positioning systems for stir-friction welders, and methods for using such systems. The methods include the steps of rotating the pin tool, and applying force to the pin tool with the pin tool plunged into one side of the workpiece, and with a shoulder of the pin tool essentially coincident with the surface of the one side of the workpiece, so that the rotating pin creates a friction-stirred region. The workpiece and the rotating tool are moved laterally (in a direction orthogonal to the axis of rotation) relative to each other, so that the friction-stirred region progresses along the workpiece. During the moving step, a signal is generated which is representative of the force applied to the pin tool. A reference signal is generated which is representative of that force which is sufficient to

maintain the shoulder against the one surface of the workpiece. A signal representative of the force applied to the pin tool is compared with the reference signal, for generating an error signal representative of the difference between the force applied to the pin tool and the reference signal. The error signal is used to control the step of applying force in a manner tending to maintain the shoulder in contact with, or essentially coplanar with, the one surface of the workpiece, as a result of which, or whereby, the pin maintains substantially constant plunge depth. See column 2, lines 32-55. See also column 3, lines 5-19, disclosing that the method may further include initial steps which cause the pin tool to plunge into the workpiece, these steps including positioning the tip of the pin tool adjacent the one surface of the workpiece and generating a signal representing the plunge of the pin tool relative to the one surface of this workpiece; and other steps including generating a monotonically changing signal which represents a profile of the desired depth of plunge as a function of time, generating a difference signal representing the difference between the actual plunge of the pin tool and the desired depth of plunge, rotating the pin tool, and controlling the force in response to the difference signal in such a manner that the force increases when the actual plunge is less than the desired plunge, and decreases when the actual plunge is more than the desired plunge, the step of moving the workpiece and the rotating tool laterally relative to each other beginning when the actual plunge equals the desired plunge.

It is respectfully submitted that Adams, et al. discloses generation of difference signals representing, for example, a difference between the actual plunge of the pin tool and the desired depth of plunge. It is respectfully submitted that this

patent does not disclose, nor would have suggested, such controller as in the present claims, for controlling a relative distance in a tool insertion direction between the tool and the work and an insertion depth of the tool into the work so that a load factor or electric current of the spindle motor is within a predetermined range, or such controller together with the rotating tool which is tilted at a predetermined angle θ to the work toward a rear side with respect to a direction of moving the rotating tool relative to the work. It is emphasized that Adams, et al. discloses a pin tool which is perpendicular to the workpiece, and it is respectfully submitted that this reference would have taught away from the tilting of the tool, together with the controller, and advantages thereof as achieved by the present invention.

The contention by the Examiner in Item 4 on page 4 of the Office Action mailed September 17, 2004, that Hirano, et al. discloses a controller as in the present claims, the Examiner referring to column 6, lines 1-56 of Hirano, et al., is respectfully traversed. Hirano, et al., at column 6 as referred to by the Examiner, discloses friction stir welding apparatus including control of the push-in quantity of the rotating tool. In connection therewith, it is respectfully submitted that there is no disclosure of tilted rotating tools. It is respectfully submitted that this reference does not disclose, nor would have suggested, the controller controlling the relative distance in tool insertion direction and insertion depth so that the load factor or electric current of the spindle motor is within a predetermined range, in an apparatus and method wherein the rotating tool as inserted in the work is tilted, as in the present claims.

Contentions by the Examiner in connection with Yoshinaga, in the last paragraph on page 4 of the Office Action mailed September 17, 2004, are noted. However, it is respectfully submitted that this reference does not disclose, nor would have suggested, the controller as in the present claims, controlling the relative distance in tool insertion direction and insertion depth so that the load factor or electric current of the spindle motor is within the predetermined range, with the rotary tool tilted, as in the present claims, and advantages thereof.

Again, in particular since Adams, et al. does not show a tilted rotating tool, it is respectfully submitted that this reference clearly would have neither disclosed nor would have suggested the present invention, including use of the controller with the tilted rotating tool, and advantages thereof.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 500.41512CX2), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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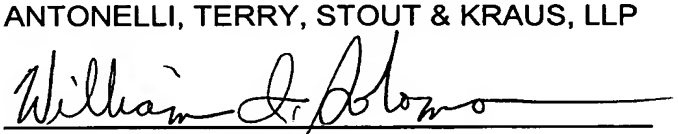

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